Bee Biology
Made Simple

James and Chari Elam
BluebonnetBeekeeping.com
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Caste of Bees

Worker

Sexually immature female

Queen

Sexually developed female and sole function is to lay eggs

Drone

A few to several hundred (sexually developed males)
The Queen is the heart and soul of the colony. She is the reason for nearly everything the rest of the colony does. She is the only bee the colony can not survive without.

- Constantly fed royal jelly by attendants
- Number of eggs laid depends on amount of food she’s fed and size of workforce
- Lays up to 2000 eggs per day depending on the time of the year
- Average productive live span, 2-3 years

Can sting, but won’t die after...WHY?
The Queen...

- 16 days to emerge
- Leaves on mating flight about 1 week after
- Travels quite a distance to mate to prevent inbreeding
- Circles the hive to orient location of colony
- Mates with 10 – 40 drones at an altitude of over 20 feet (may make more than 1 flight)
- If bad weather prevents this flight for over 20 days, she loses ability to mate
- Begins laying in 48 hours of return
- With each egg she lays, she releases several sperm
- If laying in larger, drone-sized cell, she doesn’t release sperm (therefore drone will result)
Pheromone: QMP – Queen Mandibular Pheromone
QMP drives the entire colony
Directs the colonies daily activities, from telling the workers to feed and groom her, to preventing the rearing of new queens as well as prevention of the development of laying workers.

If my workers can’t detect my pheromone, they will begin to replace me!

When a queen dies or is lost, workers select a few young worker larvae and feed them a special food called “Royal Jelly”.

Definition of Royal Jelly - a substance secreted by honeybee workers and fed by them to larvae that are being raised as potential queen bees
The queen lays all her eggs in hexagonal beeswax cells built by workers.

Developing young honey bees (called brood) go through four stages....
4 Stages:
Egg, Larva, Pupa and Adult
Development stages of the Queen, Worker and Drone.
## Life Cycle “Development” in detail

<table>
<thead>
<tr>
<th>Type</th>
<th>Egg</th>
<th>Larva</th>
<th>Cell capped</th>
<th>Pupa</th>
<th>Average developmental period (Days until emergence)</th>
<th>Start of fertility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Queen</td>
<td>up to day 3</td>
<td>up to day 8½</td>
<td>day 7½</td>
<td>day 8 until emergence</td>
<td>16 days</td>
<td>day 23 and up</td>
</tr>
<tr>
<td>Worker</td>
<td>up to day 3</td>
<td>up to day 9</td>
<td>day 9</td>
<td>day 10 until emergence (day 11 or 12 last molt)</td>
<td>21 days</td>
<td>N/A</td>
</tr>
<tr>
<td>Drone</td>
<td>up to day 3</td>
<td>up to day 9½</td>
<td>day 10</td>
<td>day 10 until emergence</td>
<td>24 days</td>
<td>about 38 days</td>
</tr>
</tbody>
</table>
Brood from egg to pupa

First 8 Days

Capped day 9
For worker

3 Days
Worker

The majority of the hives population are female workers. Workers are smaller than the queen, their abdomens are shorter, and on their hind legs they have pollen baskets, which are used to carry pollen back from foraging.

Like the queen, the worker bee has a stinger. Her stinger is not smooth like the queen’s, but has a barb on the end. The barb causes the stinger to stay in the person she stings.
<table>
<thead>
<tr>
<th><strong>Structure of organ</strong></th>
<th><strong>Location</strong></th>
<th><strong>Function</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>head glands</td>
<td>front of the head</td>
<td>produce brood food and royal jelly</td>
</tr>
<tr>
<td>wax glands</td>
<td>under the abdomen</td>
<td>produce wax</td>
</tr>
<tr>
<td>odor glands</td>
<td>near upper tip of the abdomen</td>
<td>produce scent to orientate bees when the colony is disturbed</td>
</tr>
<tr>
<td>sting and associated glands</td>
<td>tip of the abdomen</td>
<td>defend the colony</td>
</tr>
<tr>
<td>long tongue</td>
<td>head</td>
<td>gathers nectar</td>
</tr>
<tr>
<td>honey stomach</td>
<td>enlarged aera of esophagus</td>
<td>carries nectar and water</td>
</tr>
<tr>
<td>pollen comb, press and basket</td>
<td>hind legs</td>
<td>comb pollen from the body, press it into pellets, and carry it to hive. Also used to carry propolis</td>
</tr>
</tbody>
</table>
It is very important to know the “duties” of each age of bee...Why?

<table>
<thead>
<tr>
<th>Days after emergence</th>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>clean cells and warm the brood nest</td>
</tr>
<tr>
<td>3-5</td>
<td>feed older larvae with honey and pollen</td>
</tr>
<tr>
<td>6-10</td>
<td>feed younger larvae with products of the head glands</td>
</tr>
<tr>
<td>11-18</td>
<td>ripen nectar, produce wax and construct comb</td>
</tr>
<tr>
<td>19-21</td>
<td>guard and ventilate the hive, take exercise and orientation flights to learn to fly and locate the hive</td>
</tr>
<tr>
<td>22+</td>
<td>forage for nectar, pollen, water or propolis</td>
</tr>
</tbody>
</table>
How do bees make wax?
The glands of worker bees convert the sugar contents of honey into wax, which oozes through the bee's small pores to produce tiny flakes of wax on their abdomens. Workers chew these pieces of wax until they become soft and moldable, and then add the chewed wax to the honeycomb construction.
Drone

The only Male bee in the colony. Drones make up a small percentage of the hive’s total population. New beekeepers often mistake a drone for the queen, because he is larger and stouter than a worker bee. But his shape is in fact more like a barrel. The drone’s eyes are huge and seem to cover his entire head. He doesn’t forage for food from flowers, and he has no pollen baskets. He doesn’t help with the building of comb because he has no wax-producing glands; and can’t help defend the hive because he doesn’t have a stinger!

- Generally seen in colonies during late spring and summer
- Function is to fertilize queen
- Orientation flights begin at 8 days old, normally between noon & 4:00 pm
- Die after mating
- Can feed themselves, but rely on workers to be fed
- Eat 3 times the food as workers
- Kicked out of colony in the fall
Honeybees use “Climate control”

- Brood nest temperature is of extreme importance to the colony and is controlled with utmost precision.
- Honey bees maintain the temperature of the brood nest between 90°F and optimally 95°F so that the brood develops normally.
- When the temperature in the nest is too high the bees ventilate by fanning the hot air out of the nest or use evaporative cooling mechanisms.
- When the temperature is too low, bees generate metabolic heat by contracting and relaxing their flight muscles (having uncoupled the wings from them). The resulting vibration generates heat in those muscles.
- Many insects heat up their flight muscles before taking off, but bees have perfected this function to thermo-regulate their environment.
Honey bee nutritional requirements

Honey bees, like all animals, require a balanced diet of sugar, protein, vitamins and minerals. Water is also a vital nutritional requirement.
Nectar is bees' energy source (Carbohydrate) and is extremely important for growth, laying of brood, flying and keeping warm.

Beekeepers supplement their food with sugar water - However, feeding sugar only is a stimulus to the bees and not a balanced diet.

Stored honey is a very good energy source, but bees are reluctant to use it unless they really need it. They use it only when there is no fresh nectar available, such as during a drought or in winter. It does not stimulate the queen to lay, except in the spring when natural brood expansion occurs.
Pollen/Protein
• Pollen is the bees' main source of protein, and is required for muscle growth in brood and young adult bees.
• Bees obtain pollen from flowers or from pollen stored in the combs.
• They can also draw on body-protein when they are protein-stressed, such as occurs in a spring build-up or a heavy honey flow.
• They consume body-protein to create royal jelly to feed their brood. This is similar to a cow using body tissue to produce milk for a calf.
When we talk biology, we can’t help but talk about...

**Swarms**

What is a swarm? A body of honeybees that leave a hive and fly off together, accompanied by a queen, to start a new colony.

- Swarming is a NATURAL part of beekeeping!
- Our goal as beekeepers is to “control” swarms in our favor.
- Swarm is most always the OLD queen and 50-60% of the colony
**Queen** - the reason a colony swarms...WHY?

- Congestion (Queen doesn’t have enough room)
- Unbalanced numbers (too many foragers...queen isn’t laying properly) – *Causes???
- Overheating
- Defective comb
- Inclement Weather
- Failing Queen
- Decline in pheromones
- Genetics
- Idle nurse bees

*I am not happy with the situation in here!*
Other reasons bees swarm:
• Starvation
• Disease
• Pest infestation

Or
The beekeeper is opening the hive box too often!
Knowing Bee Biology is the most important aspect of being a successful beekeeper!

I’m depending on YOU!
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